INSTALLATION FOR THE MANUFACTURE OF A MULTI-LAYER MATERIAL AND MATERIAL THUS OBTAINED

The present invention refers to an installation for the manufacture of a multi-layer material and to the material thus obtained.

The multi-layer materials are present in many different fields and particularly in the packaging industry. One material usually used is the corrugated cardboard. For report, the corrugated cardboard is produced by covering a sheet, which is beforehand corrugated by travelling through two fluted cylinders, with two cover sheets which are stuck on the top of the central sheet corrugations.

In the packaging industry, the corrugated cardboard finds its main use as particularly resisting protective packaging, while being associated to an environmental respect related to its relative easy recycling.

Another use of a relatively thin corrugated cardboard finds its way in more attractive-looking packaging needed for a special range of products. It is necessary, in this case, to print this corrugated cardboard. This printing process is possible thanks to the progress reached with flexographic printing techniques which allow to reach high quality printings in several colors.

However, the printing of a corrugated cardboard should be inconvenient, that means that this printing will show lines related to each corrugations top since, at the time of the printing process, the corrugated cardboard will be slightly crushed. The different resistance between the top of the corrugations and the segment between two consecutive tops is the main reason for these lines to appear at the time of the printing process.

The manufacture of a corrugated cardboard is carried out by means of a complex machine such as a corrugating device which includes a paper feeding station, made of reels, for a corrugating station, a paper feeding station, made of reels, for a first cover sheet, a paper feeding station, made of reels, for a possible second cover sheet, a gluing device for the glue deposit on the top of the corrugations, a pressing station for the gluing of the second cover sheet on the tops of the corrugated sheet, devices for longitudinal and transverse cutting of the corrugated sheet and a delivery station for cardboard sheets cut at the requested format. Generally, all the operations carried out on the various sheets comprised in the corrugated cardboard are carried out at high temperature, up to around three hundred degrees, and often in a wet ambient.

More than its bad printability, the corrugated cardboard shows a bad mechanical resistance into a parallel direction related to the corrugations and it is

very often “warped ”; that means that it is curved and effectively not easy to handle with either within the printing or the die-cutting machines. The corrugations require a significant quantity of paper and the gluing of cover sheets on the top of the corrugations requires also a significant supply of glue.

The processes currently used to manufacture a multi-layer material show all the above mentioned disadvantages, essentially related to the configuration of the reference materials.

The aim of this invention is to overcome, at least partly, the disadvantages shown by a multi-layer material of a kind such as said one.

To this end, the invention relates to an installation for the manufacture of a multi-layer material as defined by claim 1 and to the material thus obtained as defined by claims 6 to 8.

However, thanks to its layout, the installation effectively allows a wide using flexibility and adaptability to the manufacture of a multi-layer material which allows the lowering of its unit weight when ensuring a rigidity into at least two directions as well as an excellent printability.

Several other characteristics and significant advantages of this installation as well as of the material thus obtained will be shown with the following description and also with the enclosed drawings which illustrate, schematically and as an example, an embodiment of the installation and of said material.

Fig. 1 is a schematic view of an installation for the manufacture of a first multi-layer material,

Fig. 2 is a schematic view of an installation for the manufacture of a second multi-layer material,

Fig. 3 is a perspective view of a material structured on only one side,

Fig. 4 is a perspective view of a material structured on both sides,

Fig. 5 is an increased sectional view of the material of fig. 3 structured on only one side,

Fig. 6 is an increased sectional view of fig. 4 structured on both sides,

Fig. 7a to 7c relate the different structures of the materials,

Fig. 8 is a view representing a box manufactured by the multi-layer material issued from the installation of fig. 1,

Fig. 9 is a sectional view of a tool used to perform a material structured on one side and,

Fig. 10 is a sectional view of a tool used to perform a material structured on both sides.

Fig. 1 is a schematic view of an installation for the manufacture of a first multi-layer material 13. On this fig., one missed to show, in order to simplify the

drawing, the paper feeding stations, which are well-known from the machines manufacturers. These paper feeding stations usually comprise a reel stand equipped with a reels driving and braking device related to a device used to connect a new reel to the last part of a reel at the end of its unfolding to ensure the paper feeding continuity for the next installation bodies.

The installation of Fig. 1 comprises a formation station 1 of a structured web 2. This formation station 1 includes a cassette 3 comprising two side frames 4, 5 between which two cylindrical tools upper 6 and lower 7 are settled and intended to deform, primarily on one side, a paper web 8 issued from a first paper feeding station (not represented). The lower cylindrical tool 7 is preferably connected to a vacuum source so that the structured web 2, deformed on one side at the engaging point between the upper cylindrical tool 6 and the lower cylindrical tool 7, is maintained, by sucking, against part of the circumference of the latter. An example of a tool allowing the deformation of the structured web on one side will be described related to Fig. 9. The asperities of the structured web 2 which are in the sucking area of the cylindrical tool 7 are glued by means of a gluing unit 9 comprising a gluing roller 10 dipping into a glue tank 11. The glue quantity laid onto the asperities of the structured web 2 is controlled by a drying roller 12. For obtaining a first multi-layer material 13, a second paper web 14 issued from a second paper feeding station (not represented), similar to the said first feeding station, is laid onto the tops of the glued asperities of the structured web 2 by means of a pressing cylinder 15. The first multi-layer material web 13 travels then around an idling cylinder 16 before it comes into a longitudinal cutting station 17. This well-known longitudinal cutting station 17 comprises two side frames 18 and 19 between which circular cutting tools 20 and 21 are arranged. The also well-known circular cutting tools 20 are made of circular blades adjustably secured, into the width of the longitudinal cutting station 17, in order to obtain first multi-layer material webs 13 of different widths. The side cut of the first multi-layer material web 13 is also completed in this station. The circular cutting tool 21 generally comprises an anvil tool with adjustable sleeves, into the width of the longitudinal cutting station 17, said sleeves showing circular grooves, which can be located at the opposite side of the circular blades of the circular cutting tools 20. One noticed that in a special kind of longitudinal cutting machines, the circular cutting tool 21 can be shaped like an anvil cylinder covered, for example, with a material such as polyurethane. The first multi-layer material web 13 is then introduced into a transverse cutting machine 22 comprising two side frames 23 and 24. This transverse cutting machine 22 is also well-known from machines manufacturers. It comprises, first of all, an upper rotary tool 25 provided with a knife, generally helocoidally shaped and a lower anvil

cylinder 26 which can either be out of steel or covered with polyurethane. Knowingly, the higher rotary cutting tool is actuated in order to carry out cuttings of different lengths of the first multi-layer web 13, in accordance to the various required formats. At the output of the longitudinal cutting station 22, sheets 27 of the first multi-layer material 13 are conveyed on a belt conveyor 28 to a stacking station 29, schematically represented here by a device comprising a piling member 30 able to form a pile 31.

Fig. 2 is a schematic view of an installation for the manufacture of a second multi-layer material 40. The installation of this fig. is different from the one represented on Fig. 1 only due to the addition of an insertion station 32 of a cover web 33 on the multi-layer material 35 to carry out the second multi-layer material 40. Consequently, the common bodies to both achievements will have the same references.

On this Fig., one missed, in order to simplify the drawing, to show the paper feeding stations which are well-known from machines manufacturers. Knowingly, one recalls that these paper feeding stations generally comprise a reel stand equipped with a paper reels driving and braking device related to a device for connecting a new reel to the last part of a reel at the end of its unfolding, so that the paper supply continuity is ensured for the next bodies of the installation.

The installation of Fig. 2 also comprises a formation station 1 of a web structured on both sides 34. This formation station 1 includes a cassette 3 with two side frames 4, 5 between which two cylindrical upper 6 and lower 7 tools are arranged and intended to deform, on both sides, a paper web 8 issued from a first paper feeding station (not represented). The lower cylindrical tool 7 is preferably connected to a vacuum source so that the structured web 34 deformed at the engaging point between the upper cylindrical tool 6 and the lower cylindrical tool 7 is maintained, by sucking, against part of the circumference of the latter. An example of a tool allowing the deformation of the structured web on both sides will be described related to Fig. 10. The asperities of one side of the structured web 34 located in the sucking circumference area of the cylindrical tool 7 are glued by means of a gluing station 9 including a gluing roller 10 dipping in a tank 11. The glue quantity laid onto the asperities of one side of the structured web 34 is controlled by means of a drying roller 12. This gluing unit 9 can either use a starch-based glue or a vinyl glue. For obtaining a multi-layer material 35, a second paper web 14 issued from a second paper feeding station (not represented), identical to said first feeding station, is laid onto the tops of the glued asperities of one side of the structured web 34 by means of a pressing cylinder 15. The multi-layer material web 35 travels then around an idling cylinder 16 before being conveyed into an

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insertion station 32 of a cover web 33 issued from a third paper feeding station (not represented), identical to said first and second feeding stations. The asperities of the other side of the structured web 34 are glued by means of a gluing unit 36 identically arranged as the gluing unit 9 related to Fig. 1. This gluing unit also can either use a starch-based glue or a vinyl glue. The gluing roller 38 of this gluing unit 36 deposits glue on the asperities of the other side of the structured web 34 owing to the idling cylinder 16. The glued asperities of the other side of the multi-layer web 35 are thus overlapped by the cover web 33 by means of the pasting down cylinder 39 for obtaining the second multi-layer material 40. This multi-layer material 40 is then conveyed onto a pressing device 41 including a table 42 and a pressing device equipped with a range of rollers 43. It is obvious that several of these pressing devices 41 may comprise a belt conveyor instead of a feed table 42.

The web of the second multi-layer material 40 is then conveyed into a longitudinal cutting station 17 identical to said one related to Fig. 1. Knowingly, this well-known longitudinal cutting station 17 comprises two side frames 18 and 19 between which circular cutting tools 20 and 21 are settled. The also well-known circular cutting tools 20 are made of circular blades adjustably secured in the width of the longitudinal cutting station 17, for obtaining first multi-layer material webs 13 with different widths. The side cutting of the second multi-layer material web 40 is also achieved in this station. The circular cutting tool 21 generally comprises an opposite tool equipped with adjustable sleeves, arranged in the width of the longitudinal cutting station 17, said sleeves showing circular grooves which can be located opposite to the circular blades of the circular cutting tools 20. One notices that for some longitudinal cutters, the circular cutting tool 21 can be shaped like an anvil cylinder (?) covered, for example, with a material such as polyurethane. The web of the second multi-layer material 40 is then introduced into a transverse cutter 22 which comprises two side frames 23 and 24. This transverse cutter 22 is also well-known from the machines manufacturers. It comprises first of all an upper rotary tool 25 equipped with a blade, usually helicoidally shaped, and a lower anvil cylinder 26 which is either of steel or covered with polyurethane. Knowingly, the rotary upper cutting tool is driven for ensuring cuttings of the second multi-layer material web 40 of different lengths, according to different required formats. At the output of the transverse cutting station 22, sheets 44 of the second multi-layer material 40 are conveyed on a belt conveyor 28 up to a stacking station 29, schematically represented here by a device comprising a piling member 30 intended to form a pile 31. The stacking stations are also well-known from the machines manufacturers and will thus not be described in details. More likely, the

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paper web 8 having to be deformed will be accordingly humidified in the same way as it is the case for corrugated cardboard production machines.

Fig. 3 is perspective view of a material 2 structured on one side. Said structure is made of cells 45, issued for example from the tool which will be described further related to Fig. 9.

Fig. 4 is a perspective view of a material 34 structured on both sides. The structure represented here is made of cells 46 and 47, issued for example from the tool which will be further described related to Fig. 10.

Fig. 5 is an increased sectional view of material 2 of Fig. 3 only structured on its side 48.

Fig. 6 is an increased sectional view of material 34 of Fig. 4 structured on both sides 48 and 49.

Fig. 7a to 7c show the structure of materials 2 and 34.

Fig. 8 is a view representing a box 50 manufactured by the multi-layer material 13 issued from the installation of Fig. 1. This box 50 is obviously the use example of a multi-layer material 13 with an aesthetic looking related to the promotion of a product. A possible use for advertising material is also intended. Obviously, such results cannot be reached by using a multi-layer material like corrugated cardboard.

Fig. 9 is a partial sectional view of a tool 51 used to perform a material 2 structured on its side 48. This tool 51 comprises an upper cellar cylinder 52 and a lower cellar cylinder 53. The two cylinders cells interpenetrate and deform the paper web 8 and thus obtain a web material 2 only structured on its side 48. The lower cellar cylinder 53 is arranged to ensure the maintenance of the textured web material 2 at the bottom of the cells of part of its circumference, by means of channels 54 connecting each cell to the empty central part of cylinder 53 connected itself to a vacuum source (not represented). For obtaining a structured web material 2 with a structure of low thickness, it is not necessary for the tool 51 to reach a high temperature. In case of structures with more significant thickness, it will be necessary to heat the tool 51 up to a temperature of about 300°centigrades. For structures with very low thickness, of about 0,2 to 0,6 millimeter, one can carry out a more simple tool 51 using only one lower cellar cylinder 53 connected to a powerful vacuum source so that the vacuum action on the paper web 8 at the bottom of the cells produces the required deformation for obtaining the structured material web 2. The achievement of the upper and lower cellar cylinders can be easily carried out for example by an electro-erosion process.

Fig. 10 is a sectional view of a tool 55 used to perform a structured material 34 on both sides 48 and 49. This tool 55 comprises an upper cellar cylinder

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56 and a lower cellar cylinder 57. The two cylinders cells interpenetrate and deform the paper web 8 for obtaining a structured web material 34 on both sides 48 and 49. The lower cellar cylinder is arranged for maintaining the textured material web 34 at the bottom of the cells of part of its circumference, and thus by means of channels 58 connecting each cell to the grooved section in the middle of the cylinder 57 connected itself to a vacuum source (not represented). For obtaining a structured material web 34 with a low-sized thickness structure, it is not necessary for the tool 55 to reach a high temperature. In case of more important thickness structures, it will be necessary to deal with the heating of the tool 55 up to a temperature of 300° centigrades. For very slight thickness structures, of about 0,2 to 0,6 millimeters, one can deal with a more simple tool 55, as for the tool 51 of Fig. 9, using only one lower cellar cylinder 57 connected to a powerful vacuum source so as the vacuum action on the paper web 8 at the bottom of the cells causes the required deformation for obtaining the structured web material 34. The achievement of the upper and lower cellar cylinders can advantageously be carried out for example by an electro-erosion process.

The above mentioned installation for the manufacture of a multi-layer material allows, among others, obtaining, if one uses a web structured on both sides with a special decorative printing, as the ones shown for example on Fig. 7a to 7c, an embossing multi-layer material, which offers a wide range of use of this material either for an ornamental supply or another one.